REMARKS

Claims 1-20 were originally pending, of which claims 1, 7-9, 14 and 20 were amended and to which claims 21-26 were added in the response to a first Office action. Claims 1, 9, and 14 are twice amended herein, and claims 2, 3, 4, 10, 11, 12, 15, 16, 18, 21, 22, and 23 are first amended herein. Also, claim 5 is canceled herein. Claims 1-4 and 6-26 are now pending. It is respectfully submitted that the pending claims define allowable subject matter.

In the outstanding Office Action, the drawings are objected to under 37 C.F.R. 1.83 (a) as not showing every feature of the invention specified in the claims. The specification is objected to under 35 U.S.C. §112, first paragraph, as failing to support the invention as it is now claimed. Claims 1-26 are rejected under 35 U.S.C. §112, first paragraph, for the reasons set forth in the objection to the specification. Claims 11 and 14 are rejected under 35. U.S.C §112, second paragraph, as being indefinite. Claims 1-26 are rejected under 35 U.S.C. §103 as being unpatentable over Baptist (6259765 PCT published 12/98). Applicants respectfully traverse the foregoing rejections and objections for reasons set forth hereafter.

It is respectfully submitted that the drawings and specification clearly describe where and how different voltages may be applied to the grid 120 with a grid voltage supply 124 that is a variable voltage supply. The drawings clearly illustrate the grid voltage supply 124, the grid 120, and the cathode filament 118. The specification states that the grid voltage supply 124 may be variable in order to apply an ion collection voltage on the order of 10 to 30 volts, a voltage to focus an electron beam on the order of 100 to 300 volts, and a voltage to stop the electron beam on the order of several kilovolts. Each of the voltages may be applied to the grid 120 to perform the corresponding functions (i.e., ion collection, electron beam focusing, stopping the electron beam)

and are negative with respect to the filament bias connection 127. Such a variable grid voltage supply is currently claimed herein in the amended claims. Various means for adapting (i.e., controlling) an output voltage level of a variable voltage supply are well known in the art.

Therefore, it is respectfully submitted that the means for supplying the different voltages to perform the different functions is clearly shown in the drawings and described in the specification as the variable grid voltage supply 124 being connected between the cathode filament 118 and focus grid 120 and, therefore, the objections to the drawings under 37 C.F.R. 1.83 (a) and to the specification under 35 U.S.C. §112, first paragraph, should be removed. Also, it is respectfully submitted that the rejection to claims 1-26 under 35 U.S.C. §112, first paragraph, for the same reasons set forth in the objection to the specification, should be removed as well.

Claims 11 and 14 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention as the claims are allegedly incomplete. Claims 11 and 14 have been amended to address the issues raised by the Examiner. The specification clearly teaches selecting a voltage level to apply to the grid 120 to minimize high voltage breakdowns within the X-ray tube (i.e., determining which ion collection voltage results in the greatest reduction in high voltage breakdowns). It is also clear to one of skill in the art what it means to provide an X-ray detector to receive an electron beam. It is submitted that the amended claims are fully responsive to the Examiner's rejection and define allowable subject matter.

Claims 1-26 are rejected under 35 U.S.C. §103 as being unpatentable over Baptist (6259765 PCT published 12/98). It is respectfully requested that the rejection of claims 1-26 under 35 U.S.C. §103 be withdrawn since a prima facie case of obviousness has not been established. The outstanding Office Action only sets forth certain general teachings of Baptist in support of a general

obviousness rejection of all of the pending claims 1-26. In the obviousness rejection, differences between the prior art and the claimed invention have not been identified. Also, no explanation has been provided that would serve as a motivation to the artisan to modify the prior art in a manner that would render obvious the claimed invention. Also, no discussion is provided concerning the alleged obviousness of the features of the dependent claims, for example, the Faraday cage.

Further, it is respectfully submitted that Baptist does not teach or suggest the claimed invention. The claims generally concern an X-ray tube subsystem and method for operation thereof comprising a variable voltage supply connected between the grid bias connection and the filament bias connection to produce a negative output voltage level at the grid bias connection with respect to the filament bias connection, the output voltage level of the variable voltage supply adapted to produce a first voltage level to focus an electron beam, a second voltage level to sweep free ions out of the X-ray tube, and a third voltage level to stop the electron beam. When the second voltage level (ion collection voltage) is applied to the grid, free positive ions that are created within the X-ray tube are swept away (i.e., collected) from the cathode filament by the grid to prevent high voltage breakdown events.

The Examiner states that tube operation requires that grid 120 be biased for electron focusing. However, the specification does not teach such a restriction and such a restriction is not claimed. Therefore, it is respectfully submitted that the Examiner's objections and/or rejections based on such a restriction should be removed.

The prior art fails to teach or suggest structure or steps for creating/producing an ion collection voltage for collecting positive ions at a grid. Nor does the prior art teach or suggest the claimed cathode filament in combination with an ion collection voltage.

Baptist is concerned with a method for creating an electron beam using an electron cathode source with at least one microtip (not a filament) and using an extraction grid and magnetic field to help form and focus the electron beam. Baptist does not teach or suggest a cathode filament or filament connection but instead describes a cathode microtip which substantially differs from a cathode filament. Baptist specifically teaches away from using a filament by stating "Furthermore, the structure of X-ray tubes with filaments does not make it possible to define any specific shape of the X-ray source, i.e. the zone of the tube from which the X-rays are emitted, in an accurate and controllable fashion." (column 3, lines 1-4). Also, Baptist does not teach or suggest collecting the positive ions or using a grid for ion collection. Instead, Baptist describes repelling or pushing the positive ions away from a separate, dedicated intermediate grid toward the anode to keep the positive ions away from the cathode microtip. Baptist applies a voltage potential to the separate, dedicated intermediate grid that is higher (more positive) than the voltage potential of the extraction grid to achieve the repulsion of the positive ions away from the dedicated grid towards the anode. Baptist teaches that this voltage potential is the same polarity as the anode potential and may even be higher in magnitude than the anode voltage potential (column 6, lines 59-67; column 7, lines 1-6; and column 10, lines 12 –16). In view of the foregoing differences between the prior art and the claimed invention, it is respectfully submitted that the claims are neither anticipated nor rendered obvious by the prior art.

Moreover, it is submitted that the dependent claims are non-obvious. When the X-ray tube produces positive ions, they tend to aggregate around the cathode filament and have an undesirable effect on an electric field around the cathode filament. By applying a negative ion collection voltage to the grid (as in pending claim 1) in the range of 10 to 30 volts (as in pending claim 3), these positive ions are collected (swept away) by the grid. Baptist does not teach or suggest an ion

collection voltage and does not teach or suggest applying a <u>negative</u> voltage in the range of 10 to 30 volts to a grid. Selection of an ion collection voltage (as in claim 11) is accomplished by determining the optimum ion collection voltage that minimizes high voltage breakdown events. Baptist does not teach or suggest an ion collection voltage and does not teach or suggest selecting an optimum ion collection voltage.

To focus the electron beam in a particular desirable manner, a voltage of greater than 100 volts is applied to the grid (as in pending claim 3). Baptist does not teach or suggest applying a voltage to a grid for focusing an electron beam. The grid voltage supply can be susceptible to electromagnetic interference. A Faraday cage (as in pending claim 4) can be configured to surround the variable grid voltage supply to eliminate the unwanted interference. This is accomplished by connecting the Faraday cage to the filament bias connection. Baptist does not teach or suggest a Faraday cage. The voltage applied between the anode and cathode of the X-ray tube is in the range of 100-150 kilovolts (as in pending claim 20). In column 6, lines 25-27 of Baptist, Baptist describes applying +5kV to +50kV between the anode and the microtip.

In view of the foregoing, it is respectfully submitted that the pending claims define allowable subject matter. A favorable action on the merits is respectfully requested.

Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone listed below.

Please charge any additional fees or credit overpayment to the Applicants Account 07-0845.

Respectfully submitted,

McANDREWS, HELD & MALLOY, LTD.

Date: April 23, 2003

By: ____________________

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Appendix A
(Marked-up Claims)

1. (Twice Amended) An X-ray tube subsystem comprising:

an X-ray tube including a grid connected to a grid bias connection, a cathode connected to a filament bias connection, an anode connected to an anode bias connection; and

[a grid voltage supply connected to the grid bias connection, the grid voltage supply adapted to produce separately an electron beam focus voltage and ion collection voltage at said grid, said ion collection voltage being less than said electron beam focus voltage.]

a variable voltage supply connected between the grid bias connection and the filament bias connection to produce a negative output voltage level at the grid bias connection with respect to the filament bias connection, the output voltage level of the variable voltage supply adapted to produce a first voltage level to focus an electron beam, a second voltage level to collect ions, and a third voltage level to stop the electron beam.

2. (Amended) The X-ray tube subsystem of claim 1, wherein the [ion collection voltage is in the range of 10 to 30 volts] second voltage level is substantially less in magnitude than the first voltage level.

3. (Amended) The X-ray tube subsystem of claim 1, wherein [the electron beam focus voltage is greater than 100 volts, and the ion collection voltage is in the range of 10 to 30 volts.] a magnitude of the second voltage level is greater than 100 volts, and a magnitude of the first voltage level is in a range of 10 to 30 volts.

4. (Amended) The X-ray tube subsystem of claim 1, further comprising a Faraday cage surrounding the [grid] <u>variable</u> voltage supply.

9. (Twice Amended) A method for operating an X-ray system to reduce high voltage breakdown events, the method comprising:

providing an X-ray tube that includes a grid connected to a grid bias connection and a cathode connected to a filament bias connection; and

during X-ray tube operation, [creating an ion collection voltage between the grid bias connection and the filament bias connection that is less than an electron beam focus voltage, to sweep free ions out of the X-ray tube.] <u>varying a voltage level between the grid bias connection and the filament bias connection to produce a first voltage level to focus an electron beam, a second voltage level to collect ions, and a third voltage level to stop the electron beam.</u>

10. (Amended) The method of claim 9, wherein [the step of creating an ion collection voltage comprises creating an ion collection voltage in the range of 10 to 30 volts.] <u>the second voltage level is substantially less in magnitude than the first voltage level.</u>

11. (Amended) The method of claim 9, further comprising [the step of calibrating the X-ray tube before examination to determine the ion collection voltage.] <u>selecting the second voltage level to minimize high voltage breakdowns within the X-ray tube before examination.</u>

12. (Amended) The method of claim 9, further comprising [the step of] providing a Faraday cage surrounding a [grid] variable voltage supply that [creates the ion collection voltage] generates the first voltage level, the second voltage level, and the third voltage level.

14. (Twice Amended) An X-ray examination system comprising:

an X-ray tube including a grid connected to a grid bias connection and a cathode connected to a filament bias connection;

[a grid voltage supply connected to the grid bias connection, the grid voltage supply adapted to produce separately an electron beam focus voltage and an ion collection voltage at said grid, said ion collection voltage being less than said electron beam focus voltage to sweep free ions out of the X-ray tube;]

a variable voltage supply connected between the grid bias connection and the filament bias connection to produce a negative output voltage level at the grid bias connection with respect to the filament bias connection, the output voltage level of the variable voltage supply adapted to produce a first voltage level to focus an electron beam, a second voltage level to sweep free ions out of the X-ray tube, and a third voltage level to stop the electron beam;

an X-ray detector [positioned] to receive the electron beam; and

readout electronics connected to the X-ray detector.

15. (Amended) The X-ray examination system of claim 14, wherein [the ion collection voltage] a magnitude of the second voltage level is in [the] a range of 10 to 30 volts.

16. (Amended) The X-ray examination system of claim 14, further comprising a Faraday cage surrounding the [grid] variable voltage supply.

18. (Amended) The X-ray examination system of claim 14, wherein [the ion collection voltage is a precalibrated ion collection voltage.] the second voltage level is selected to minimize high voltage breakdowns within the X-ray tube before examination.

20. (Twice Amended) The X-ray examination system of claim 14, wherein the X-ray tube operates under a tube voltage in the range of 100-150kV, [the electron beam focus voltage] a magnitude of the first voltage level is greater than 100 volts, and [the ion collection voltage] a magnitude of the second voltage level is in [the] a range of 10 to 30 volts.

21. (Amended) The X-ray tube subsystem of claim 1, wherein said X-ray tube forms positive ions about said cathode, [and said grid voltage supply produces a negative voltage at said grid to cause said positive ions to collect at said grid] and said second voltage level at said grid is negative with respect to said filament bias connection to cause said positive ions to be collected at said grid.

22. (Amended) The method of claim 9 wherein said X-ray tube produces positive ions about said cathode, [and said ion collection voltage is a negative voltage created at said grid causing said positive ions to collect at said grid] and said second voltage level at said grid is negative with respect to said filament bias connection causing said positive ions to be collected at said grid.

23. (Amended) The X-ray examination system of claim 14 wherein said X-ray tube forms positive ions about said cathode, [and said grid voltage supply produces a negative voltage at said grid to cause said positive ions to collect at said grid] <u>and said second voltage level at said grid is negative with respect to said filament bias connection to cause said positive ions to be collected at said grid.</u>